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ARMATURE ACTUATING MECHANISM FOR MAGNETOS

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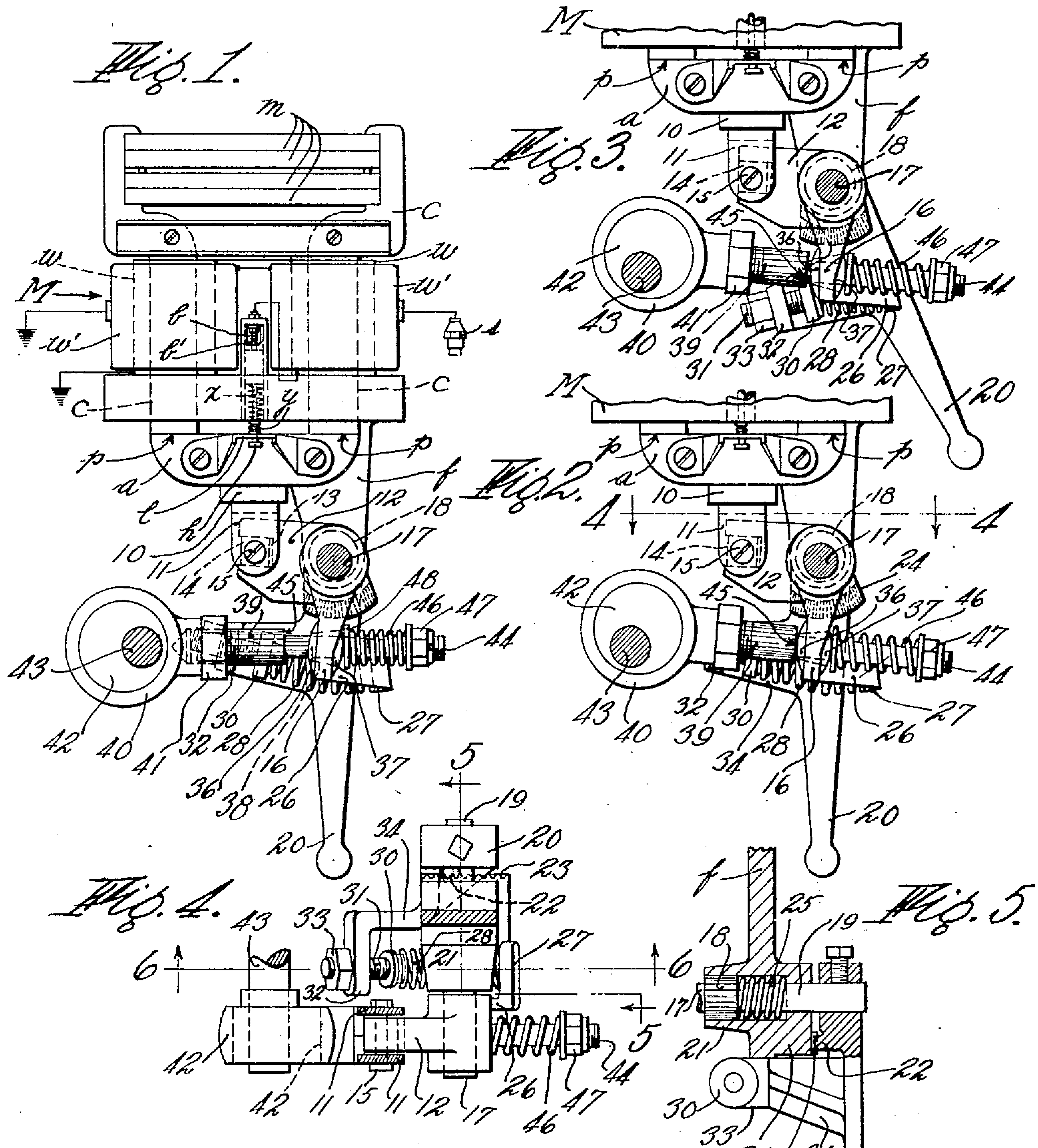

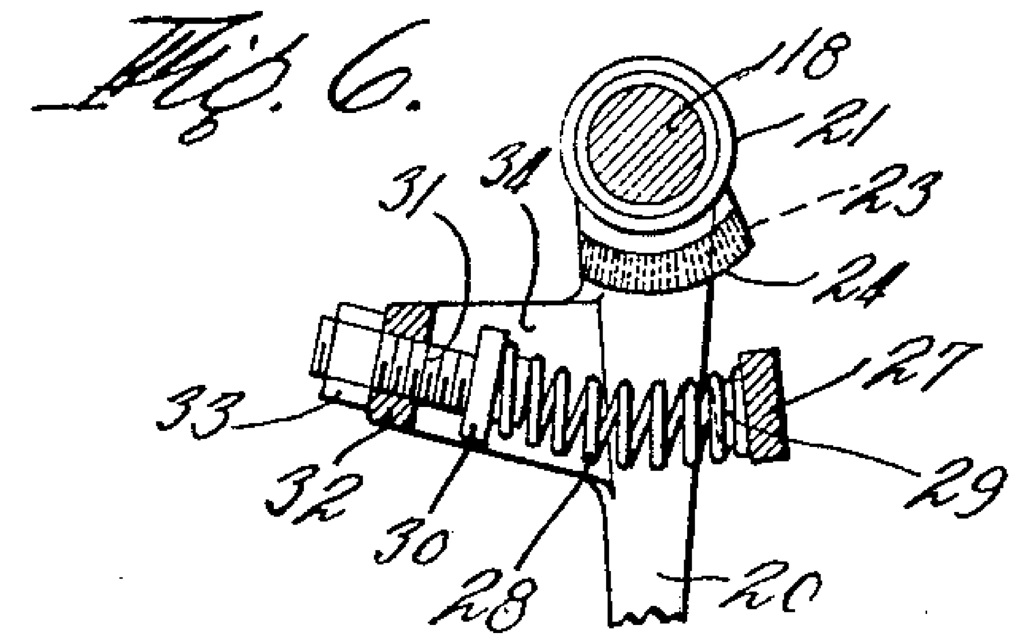

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UNITED STATES PATENT OFFICE.

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ARMATURE-ACTUATING MECHANISM FOR MAGNETOS.

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This invention relates to an improved mechanism for actuating the armatures of magnetos. The invention is particularly adapted for magnetos of that type wherein the armature is moved into and out of contact with magnetic poles and is initially moved out of contact with its poles by an inelastic transmission of force followed, if and when desired, by the expansive effort of a previously stressed elastic armature driving means. Examples of magnetos of this type will be found in the following U. S. Letters Patent:—Brown and Clark No. 1,489,382, April 7, 1924; Hendrickson No. 1,490,171, April 15, 1924; Brown and Hendrickson No. 1,517,948, December 2, 1924; Louis No. 1,517,997, December 2, 1924; and Brown et al., No. 1,532,799, April 7, 1925.

In each of these patents, the armature drive spring is placed under its driving stress by the reciprocable member, which functions to start the armature away from its poles by an inelastic transmission of force, during its active and armature starting stroke. Also the drive spring moves with the reciprocable member and thereby partakes of its kinetic energy, wherefore such energy is applied to the armature in addition to the energy due to the expansion of the spring. While this arrangement works satisfactorily, it is found that on high engine speeds the armature is moved more violently and through greater distances than is necessary, tending to result in more rapid wear and tear on the parts and somewhat noisier operation than is desired.

In my prior U. S. Letters Patent No. 1,488,975, April 1, 1924, I disclose a magneto, wherein the drive spring is made up during the return stroke of the armature and is moved toward its poles between quite heavy balanced springs, which cause the armature to be seated with relatively little noise on its poles. Also, the drive spring acts solely by its expansive effort and is not itself moved by the reciprocable member of the actuating mechanism. This arrangement, due to the heavy balanced springs, requires a considerable amount of force to operate it.

The present invention seeks to provide an improved armature actuating mechanism involving the best features of both of the two prior arrangements described with a minimizing of the disadvantages set forth.

More particularly, it is an object of the invention to provide in an armature actuating mechanism, which functions to break the magnetic hold on the armature by an inelastic transmission of force thereto, a drive spring which acts between a stationary abutment and the armature so that the spring does not, as heretofore, acquire kinetic energy from other moving parts of the mechanism.

It is also an object of the invention to provide, in a mechanism of the class described, an arrangement whereby the drive spring is placed under stress during the return flight of the armature.

It is a further object of the invention to provide, in connection with a mechanism of the type set forth, an arrangement for stressing the drive spring by a force transmitted through the armature return spring, whereby the armature may be moved toward its poles between springs which constantly seek a balance, for the purpose of seating the armature on its poles as quietly as possible.

Another object of the invention is to provide in connection with a spark timing device for the armature actuating mechanism, means whereby when the spark is retarded the tension of the drive spring is automatically increased for the purpose of supplying extra driving force for the armature at starting or low engine speeds.

Other objects and advantages will appear in the following description and in the illustrative embodiment of the invention in the accompanying drawings, in which:

Fig. 1 is a front elevational view of an armature actuating mechanism embodying the invention, showing the parts as positioned at the end of the return stroke of the mechanism;

Fig. 2 is a similar view showing the positions occupied by the parts during the forward stroke of the mechanism when the armature is about to be dislodged from its poles;

Fig. 3 is a view similar to Fig. 2 and shows the parts in the same relation except that the spark control lever has been moved to retard position:

Fig. 4 is a sectional plan view taken on the line 4—4 of Fig. 2;

Fig. 5 is a fragmentary sectional elevational view taken on the line 5—5 of Fig. 4; and

Fig. 6 is a fragmentary cross sectional view taken on the line 6—6 of Fig. 4.

Referring to these drawings; a magneto of any suitable construction is indicated at M. It has an armature *a* which is adapted to be moved toward and into contact with magnetic poles *p* and subsequently to be moved away from such poles for the purpose of varying the reluctance of a magnetic circuit. This circuit, in the example shown, includes the two cores *c*,—the ends of which constitute the poles *p*,—the armature *a* and a source of magnetic flux, which as shown comprises permanent bar magnets *m*. Primary and secondary coils *w* and *w'* are provided on each core *c*. The coils *w'* are connected, as in series, to form a generating winding in which a spark is produced by the described variation in reluctance of the magnetic circuit to supply a spark plug, such as *s*. The coils *w* are connected, as in series, to form a choke winding which, as indicated, is part of an electrical circuit adapted to be closed or opened by two relatively movable breaker points *b* and *b'*. The latter is mounted on a stem *x* having a head *h* which is adapted to be engaged by a lug *l* on armature *a* during the flight of the latter away from poles *p*. whereby points *b* and *b'* are separated. A spring *y* tends to hold the points *b* and *b'* in contact.

The magneto shown is fully disclosed in United States Letters Patent No. 1,557,976, granted October 20, 1925, on an invention of Phelps Brown and Terrence G. Louis and reference is made to this patent for a full disclosure of the magneto proper. The particular magneto disclosed is merely illustrative of a general type with which the invention may be used and the details of the magneto are therefore not important to the present invention, which relates entirely to mechanism for moving the armature *a* with relation to poles *p*.

The armature *a* has fixed thereto a depending fork 10, provided with spaced arms 11, between which an arm 12 of an armature operating bell crank lever is received. The outer end of arm 12 is recessed to form a slideway 13 to receive a square block 14. The latter is mounted to turn on a stud 15, which passes through it and the spaced arms 11, forming a pivotal connection between the armature and its operating lever. The latter has a depending arm 16, which is subjected to the action of driving and return springs and a "tripping" member, as will appear.

The armature operating lever is pivotally mounted on a pin 17 which is in fact, a crank pin eccentrically located with respect to a cylindrical body 18, of which it is an integral part. The body 18 has a shank 19 projecting from its other face in concentric relation, to the outer end of which is fixed a spark control lever 20. The members 18 and 19 are rotatably mounted in a hub 21 which, as shown, is an integral part of a frame *f* by which the magneto M may be supported from an engine. The lever 20 has a projection 22, adapted to engage in any one of a plurality of recesses 23 formed in the rear face of a segmental part 24, which depends from hub 21. The latter is recessed to receive a spring 25 which acts on the member 18 with a tendency to move it to the left, as viewed in Fig. 6, for the purpose of releasably holding the projection 22 in any one of the recesses with which it may be engaged.

The lever 20 is the means for controlling the timing of the spark. It may be moved from an "advanced" position, such as that shown in Fig. 2, to a retarded position, such as that shown in Fig. 3, and to various other positions intermediate these extremes. When turned from the position shown in Fig. 3 to that shown in Fig. 2, the center of the crank pin 17 is moved to the left which effects a shifting of the armature lever to the left in substantially a horizontal path. The depending arm 16 of this lever, being moved to the left, is brought closer to the "tripping" member, as will be apparent from a comparison of Figs. 2 and 3 so that the lever is engaged and moved, and thus the armature is operated, at an earlier time.

The arm 16 of the armature operating lever is provided with an integral web 26 which extends from the rear edge of the arm in a direction opposite to but parallel and below arm 12. This web terminates with a rearward and right angularly turned part 27, forming a seat for the drive spring 28 and having a projection 29 to extend part way into this coil spring and hold the same from vertical as well as lateral displacement. The drive spring 28 is held between the seat or abutment 27 and a similar seat or abutment 30, which is fixed to a screw 31. The latter is threaded into an ear 32 and thus the position of seat 30 with relation to ear 32 may be varied, as desired—the screw being held in its various positions of adjustment by a lock nut 33. The ear 32 is connected by an integral and angular shaped web 34 to the spark control lever 20, above described.

Thus, when this lever is moved to vary the timing of the spark it also effects a variation in the tension of the drive spring by moving the abutment 32 closer to or farther away from the abutment 27. Also, as the spark is retarded, as it should be when the engine is started or is running at relatively low speeds, the drive spring tension is increased to provide for armature drive at a speed greater than and indepedent of engine speed. This will be clearly apparent from a comparison of Figs. 2 and 3. When the engine is running at higher speeds, the spark is naturally advanced and less tension is needed in the drive spring. Indeed, the drive spring, in so far as its armature driving function is concerned, can be rendered entirely inactive and the armature may be driven away from its poles at speeds proportional to engine speed and by an inelastic transmission therefrom. This result can be effected inasmuch as the tension of the drive spring is variable independently of the lever 20 by the screw 32.

The arm 16 of the armature operating lever is provided with rounded abutments 36 and 37 on opposite sides thereof,—these abutments in shape being portions of a sphere. A conical hole 38, with the small end opening centrally through abutment 36, is also provided in arm 16. A push rod is adjustably fixed, as by the screw thread connection shown, to an eccentric strap 40 and is held in its adjusted position by a lock nut 41. The strap 40 encompasses an eccentric 42, fixed on some suitable shaft 43 of the engine, with which the magneto is used,—say for example, the cam shaft. The push rod 39 therefore reciprocates continuously and its forward end 44 is reduced in diameter so as to freely slide in hole 38, by which it is supported. The intersections of the part 44 with the body of the push rod 39 affords a shoulder 45 which is the armature "tripping" member. That is, during the forward stroke of push rod 39 (to the right) the shoulder 45 will engage abutment 36, as indicated in Fig. 2, and on continued movement beyond this position will move arm 16 and cause the armature to be removed by an inelastic transmission of force from the drive shaft 43.

The movement of the armature in its flight away from the poles may be effected entirely by the inelastic transmission from push rod 39 or such transmission may be used merely in the initial stage of said flight for the purpose of breaking the magnetic hold between the armature and poles so that the drive spring 28 is enabled to subsequently move the armature. Whether the first or the second plan of operation is used depends on the tension of the drive spring 28. As above described, this tension is variable in two ways. That is, by retarding the spark, the tension of the drive spring is automatically increased and by adjusting abutment 30 the tension may be varied independently of the first adjustment. Accordingly, the combination of inelastic and elastic driving forces may be used only in starting the engine or at low engine speeds when the spark is naturally retarded. Then, when the spark is subsequently advanced the tension of the drive spring may be lowered to such an extent that its expansive effort will not be capable of moving the arm 16 as fast as the push rod 39, wherefore the armature may be driven entirely by the inelastic transmission described. On the other hand, the tension of the drive spring may be adjusted so that whatever the position of lever 20, the expansive effort of the spring 28 will drive the lever 16 ahead of shoulder 45 after the latter has initially moved the armature sufficiently to lower the magnetic pull on the armature enough to enable the spring to act. With high engine speeds, the inelastic transmission will suffice with provisions for the elastic transmission only at starting and low engine speeds. With engines which run at lower speeds, the elastic transmission may be desired at all times although naturally the force exerted by the drive spring need not be so great at normal running speeds as at starting, wherefore the tension of spring 28 is automatically decreased by the act of advancing the spark. The driving mechanism is therefore flexible in the sense that it may be adjusted over a wide range to suit the various conditions encountered.

The armature return spring is shown at 46 as a coil spring encompassing the outer part 44 of push rod 39. It is arranged between the abutment 37 and an adjustable abutment in the form of a nut 47, which is threaded on the end of part 44. A washer 48 is preferably interposed between abutment 37 and one end of spring 46 and a similar washer is interposed between the other end of spring 46 and nut 47.

The return spring is placed under stress during the return stroke of push rod 39 and through it the force is transmitted to arm 16 and thus to the drive spring 28, which is also "made up" or placed under stress during the return stroke of the armature. The return spring is first compressed during the initial stage of the return stroke until its tension becomes equal to that of drive spring 28, after which the arm 16 begins to move and during its movement it is held between two springs which necessarily seek a balance. Consequently, the armature *a* is moved toward poles *p* in a manner calculated to secure a relatively quiet seating of it on the poles. The drive spring opposes the magnetic pull on armature *a* and opposes it to a progressively increasing degree as the armature nears its poles. The armature therefore moves much more gradually toward its poles than it would if moved directly by the push rod without the interposition of the elastic connection afforded by the drive spring. After the armature *a* has been seated on its poles, the return spring continues to compress to take care of the overtravel of the eccentric 42 and insure that the armature is held tightly to poles *p*.

The armature drive spring is thereby

placed under a predetermined amount of tension which, however, may be varied within wide limits as desired to suit different conditions. The drive spring tension is, however, insufficient in itself to overcome the force of magnetic attraction when the armature is in contact with its poles. Consequently, some other force is necessary to pry the armature off its poles and this is effected by the engagement of trip shoulder 45 with abutment 36, which results in an inelastic transmission of force from the drive shaft 43 to the armature for this purpose. Once the armature has been started from its poles, the drive spring, if sufficiently tensioned, comes into play and moves the armature rapidly away from its poles carrying the arm 16 ahead of shoulder 45 under these conditions. As above set forth, with high enough engine speed, the movement of the armature in its downward flight may be effected entirely by the inelastic transmission from push rod 39 and the tension of the drive spring can then be adjusted so that it will be incapable of moving arm 16 ahead of trip shoulder 45.

An important thing to note in connection with the driving of the armature away from its poles is that the armature return spring is almost entirely relaxed before the start of the flight of the armature. Its opposition to the armature movement is virtually eliminated before the armature starts. Another important feature is that the armature drive spring does not partake of the movement of the push rod 39, as it has in all cases heretofore, where the armature has been started from its poles by an inelastic transmission of force and followed up by an elastic transmission of force to complete the flight. Heretofore, the spring has moved with the push rod and thus acquires kinetic energy. The spring is being moved at a considerable speed during its expansive action on the armature. Consequently, the armature moves through a smaller range and more quietly with less wear and tear on the various moving parts. A less driving force on the armature suffices because the return spring opposition is practically eliminated before the armature starts its flight.

The tension of the drive and return springs, while adjustable and being adjusted so that at certain times it is nearly zero, is never quite relaxed. Enough tension is provided at times of minimum spring tension to minimize any noise effect due to lost motion in the connections between the various moving parts, if and when the same exists. For example, suppose that the block 14 does not closely fit the slideway 13 so that there is a slight space between the upper edge of the block and the adjacent surface of the slideway when the parts are positioned as in Fig. 1, this lost motion is taken up quietly between the two springs before the armature starts to move. It is thereby taken up before any great stress is exerted and consequently a blow of arm 12 on block 14 is avoided. That is, as the push rod moves to the right, the return spring diminishes in tension and the drive spring will expand progressively until the upper surface of slideway 13 engages the upper edge of block 14. The two springs constantly seek a balance and the result is that there is never any considerable force available to take up the lost motion with a blow. The two parts thus move relatively slowly and quietly into contact before the inelastic armature removing force comes into play. At the end of the downward flight of armature *a*, the return spring acts as a cushion or shock absorber to arrest the same. The parts are brought to rest between springs which seek a balance and the lost motion is again taken up quietly because of the absence of any considerable driving force to produce a blow.

The operation of the armature actuating mechanism will sufficiently appear from the foregoing description.

It will also be apparent from the foregoing description that this invention provides an improved armature actuating mechanism of a flexible nature, capable of adjustment within wide limits for adaptation to engines of different types and to meet various conditions which may be encountered. It also affords an extremely quiet drive with the elimination of violent movement of the armature and reduction of its range of travel. At the same time comparatively little power is required for operation,—much less in fact than in the magneto shown in my prior Patent No. 1,488,975, above referred to. The quiet armature operation of that patent is obtained with the advantages incident to the use of the tripping of the armature by an inelastic transmission of force, resulting in greatly improved operation.

The invention has been disclosed herein, in an embodiment at present preferred, for illustrative purposes but the scope of the invention is defined by the appended claims rather than by the foregoing description.

What I claim is:

1. In a magneto, of the type wherein an armature is moved into and out of contact with magnetic poles, a rocker arm connected to move with the armature, elastic means acting on the rocker arm and exerting a force on the armature which is opposed to that of magnetic attraction and which is less than the force of magnetic attraction on the armature when the latter is in contact with its poles, and driving means reciprocable in a direction at an angle to that in which the armature moves, said driving means operable on one stroke by an inelastic transmission to

the rocker arm to overcome the force of magnetic attraction and move the armature out of contact with its poles and operable on the other stroke to move the rocker arm in the opposite direction and stress said elastic means and cause the armature to be seated on its poles.

2. In a magneto, of the type wherein an armature is moved into and out of contact with magnetic poles, a rocker arm connected to move with the armature, elatic means acting on the rocker arm and exerting a force on the armature which is opposed to that of magnetic attraction and which is less than the force of magnetic attraction on the armature when the latter is in contact with its poles, driving means reciprocable in a direction at an angle to that in which the armature moves, said driving means operable on one stroke by an inelastic transmission to the rocker arm to overcome the force of magnetic attraction and move the armature out of contact with its poles and operable on the other stroke to move the rocker arm in the opposite direction and stress said elastic means and cause the armature to be seated on its poles, and elastic means through which said driving means transmits its force to the rocker arm in returning the armature and stressing said first named elastic means.

3. In a magneto, of the type wherein an armature is moved into and out of contact with magnetic poles, a rocker arm connected to move with the armature, said rocker arm on each of two opposite faces provided with a spring seat and the axes of said seats lying in spaced parallel planes, a stationary abutment, a drive spring interposed between the latter and one of said seats, a reciprocable push rod movable alongside said drive spring and having a trip shoulder to engage the rocker arm, and a return spring carried by the push rod and engaging the other of said seats.

4. Armature actuating mechanism for a magneto of the type wherein an armature is moved into and out of contact with magnetic poles, comprising, a rocker arm for connection to the armature, a reciprocable push rod having a trip shoulder adapted on one stroke to engage the rocker arm, a return spring carried by the push rod and engaging the rocker arm, a stationary abutment, and a drive spring disposed alongside the push rod and acting between said abutment and the rocker arm.

5. Armature actuating mechanism for a magneto of the type wherein an armature is moved into and out of contact with magnetic poles, comprising, a rocker arm for connection to the armature, drive and return springs acting on opposite sides of said rocker arm at laterally spaced points, and a reciprocable push rod having a trip shoulder adapted on one stroke to engage the rocker arm and initially move it in the same direction as said drive spring tends to move it.

6. In a magneto, of the type wherein an armature is moved into and out of contact with magnetic poles, elastic driving means acting on the armature in opposition to the force of magnetic attraction and exerting less force on the armature when the latter is in contact with its poles than the force due to magnetic attraction, means operable by an inelastic transmission of force to start the armature away from its poles, and means for varying the time at which the last named means starts the armature and at the same time vary the stress in said elastic driving means, increasing or diminishing said stress accordingly as the armature is started later or earlier, respectively.

7. In a magneto, of the type wherein an armature is moved into and out of contact with magnetic poles, elastic driving means acting on the armature in opposition to the force of magnetic attraction and exerting less force on the armature when the latter is in contact with its poles than the force due to magnetic attraction, reciprocable driving means operable on one stroke by an inelastic transmission of force on the armature to overcome the force of magnetic attraction and move the armature out of contact with its poles and operable on the other stroke to move the armature toward its poles and stress said elastic driving means, and means for varying the time at which said reciprocable means starts the armature and at the same time varying the stress of said elastic driving means.

8. Armature actuating mechanism for a megneto of the type wherein an armature is moved into and out of contact with magnetic poles, comprising, a rocker arm for connection to the armature, drive and return springs acting in opposite directions on said rocker arm and having their axes in spaced and substantially parallel relation, and a reciprocable push rod having a trip shoulder adapted on one stroke to engage the rocker arm and initially move it in the same direction as said drive spring tends to move it.

9. Armature actuating mechanism for a magneto of the type wherein an armature is moved into and out of contact with magnetic poles, comprising, a rocker arm for connection to the armature, drive and return springs acting in opposite directions on said rocker arm and having their axes in spaced and substantially parallel relation, a reciprocable push rod having a trip shoulder adapted on one stroke to engage the rocker arm and initially move it in the same direction as said drive spring tends to move it, and means for varying the time at which the trip shoulder engages the rocker arm and at

the same time varying the stress of said drive spring.

10. In a magneto, of the type in which an armature is moved into and out of contact with magnetic poles, a stationary abutment, a drive spring acting between said abutment and the armature in opposition to the force of magnetic attraction, a reciprocable member having a trip shoulder to initially move the armature away from its poles by an inelastic transmission of force, an abutment on said member, a return spring acting between said last named abutment and the armature, and means for adjusting the position of said first named abutment and at the same time changing the time at which said trip shoulder acts to initially move the armature.

11. In a magneto, of the type in which an armature is moved into and out of contact with magnetic poles, a stationary abutment, a drive spring acting between said abutment and the armature in opposition to the force of magnetic attraction, a reciprocable member having a trip shoulder to initially move the armature away from its poles by an inelastic transmission of force, an abutment on said member, a return spring acting between said last named abutment and the armature, means for adjusting the position of said first named abutment and at the same time changing the time at which said trip shoulder acts to initially move the armature, and means for adjusting said abutment independently of the last named means.

12. In a magneto, of the type wherein an armature is moved into and out of contact with magnetic poles, a rocker arm connected to move with the armature, a reciprocable push rod having a trip shoulder to engage said arm, an armature return spring carried by the push rod and acting on the rocker arm in a direction opposite to that in which said trip shoulder acts, a stationary abutment, and an armature drive spring acting between said abutment and the rocker arm in opposition to said return spring.

13. In a magneto, of the type wherein an armature is moved into and out of contact with magnetic poles, a rocker arm connected to move with the armature, a reciprocable push rod having a trip shoulder to engage said arm, an armature return spring carried by the push rod and acting on the rocker arm in a direction opposite to that in which said trip shoulder acts, means for varying the position of said rocker arm with relation to said trip shoulder, an abutment carried by the last named means, and an armature drive spring acting between said abutment and the rocker arm in opposition to said return spring.

14. In a magneto, of the type wherein an armature is moved into and out of contact with magnetic poles, a pivoted rocker arm connected to move with the armature, a reciprocable push rod having a trip shoulder to engage said arm, an armature return spring carried by the push rod and acting on the rocker arm in a direction opposite to that in which said trip shoulder acts, means for moving the pivot of said rocker arm, an abutment carried by said means, and an armature drive spring acting between said abutment and the rocker arm in opposition to said return spring.

15. Armature actuating mechanism for a magneto of the type wherein an armature is moved into and out of contact with magnetic poles, comprising, a rocker arm for connection to the armature, drive and return springs acting in opposite directions on said rocker arm and having their axes in spaced and substantially parallel relation, a reciprocable push rod having a trip shoulder adapted on one stroke to engage the rocker arm and initially move it in the same direction as said drive spring tends to move it, and means for varying the time at which the trip shoulder engages the rocker arm and at the same time varying the stress of said drive spring, increasing or diminishing said stress accordingly as the rocker arm is engaged at later or earlier times respectively.

16. Armature actuating mechanism for a magneto of the type wherein an armature is moved into and out of contact with magnetic poles, comprising, a rocker arm for connection to the armature, a reciprocable push rod having a trip shoulder adapted on one stroke to engage the rocker arm, a return spring carried by the push rod and engaging the rocker arm, a lever movable to vary the time at which said trip shoulder engages the rocker arm, an abutment connected to said lever to move therewith, and a drive spring disposed alongside the push rod and acting between said abutment and the rocker arm.

In testimony whereof I have affixed my signature.

PHELPS BROWN.